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N. A. C. A. BULLETIN

Vol. XIII, No. 3 October 1, 1931

IN THREE SECTIONS

Section I

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LIBRARY

Effective Use of Cost Data

By

STACY L. ANGLE,

Auditor, Minneapolis-Moline Power Implement Co., Minneapolis, Minn.

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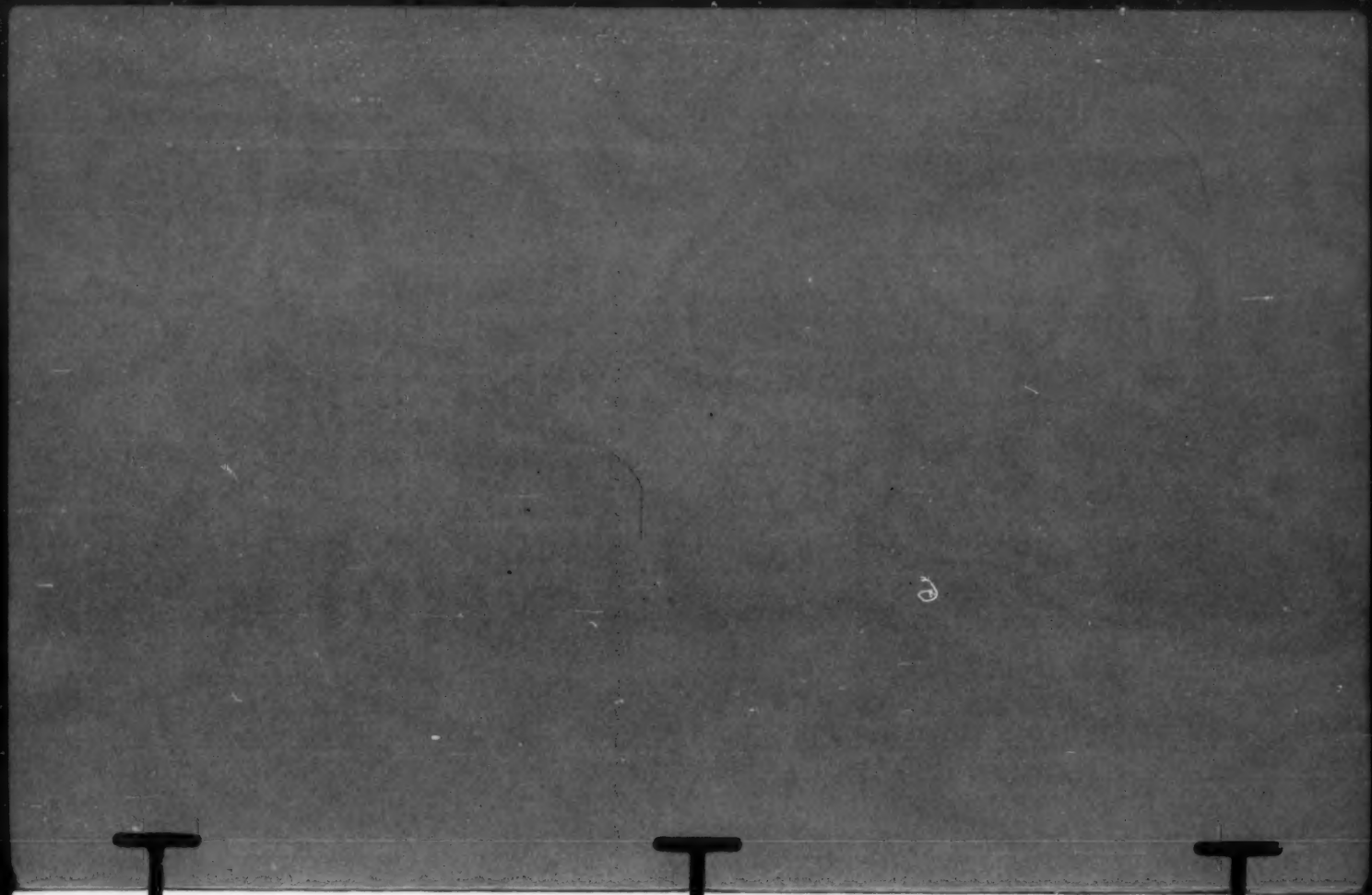

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The National Association of Cost Accountants does not stand sponsor for views expressed by the writers of articles issued as Publications. The object of the Official Publications of the Association is to place before the members ideas which it is hoped may prove interesting and suggestive. The articles will cover a wide range of subjects and present many different viewpoints. It is not intended that they shall reflect the particular ideas of any individual or group. Constructive comments on any of the Publications will be welcome.

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EDITORIAL DEPARTMENT NOTE

In this issue of our Bulletin, we are bringing to the attention of our members the problem of cost reduction, a very vital one at the present time. Very often accountants are more concerned with the problem of securing cost data than they are in the effective use of such data in the reduction of costs. The article which follows points out many ways in which the use of cost data may effectively reduce costs.

The author of this paper, Mr. S. L. Angle, after graduation from high school and after several months' training at the Oshkosh Normal School, entered the employ of the Fred Rueping Leather Co. at Fond du Lac, Wisconsin, with whom he remained for approximately two and one-half years. In 1920 he moved to Minneapolis and entered the accounting department of the Minneapolis Steel and Machinery Company, where he was engaged in various phases of accounting work.

In 1924 he was appointed to the position of Assistant Auditor and later to that of Auditor, which position he held until the consolidation of the Minneapolis Steel & Machinery Co. and two other farm implement companies into the Minneapolis-Moline Power Implement Company with which he now holds the position of Auditor

His experience has covered general, branch house and cost accounting, and general office supervision. Mr. Angle is greatly interested in the work of the N.A.C.A. and is a past president and a director of the Minneapolis Chapter.

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NATIONAL ASSOCIATION OF
COST ACCOUNTANTS
OCTOBER 1, 1931

EFFECTIVE USE OF COST DATA

I DON'T believe there has been a problem of more vital interest to manufacturers generally in recent years than that of cost and cost reduction. Although we have heard much discussion of the cost problem it has been noticeable that in practically every instance, exposition has dealt with but one phase of the cost question, namely, that of setting up and operating an improved system of one kind or another for determination of costs. The other, and by far the more important, side of the problem, that of cost reduction, or the effective use of that data, has received almost no mention. Perhaps the reason for this is that these contributions have been mainly by cost accountants who are naturally more interested in the accounting phase of the subject than they are of the uses made of this information, which probably is considered one of the functions of the production manager.

But accounting records and cost data are valuable and justify their existence and expense only in so far as they serve as tools of management to maintain and increase profits in the face of keenest competition and resulting forced price reductions. The keeping of records and the determination of cost is without question the function of an accounting department. The follow-up of these costs, or the effective use of such cost data must, however, by the very nature of our business, the manufacture principally of farm machinery, necessarily fall to others, to men who are trained in engineering, men who understand the construction of our product, the service it is to perform, engineering principles involved, and so on. But these cost follow-up men, or as we term them Cost Reduction Engineers, are not members of our engineering or production departments. They constitute a department of their own under supervision of an officer of the company and report through him directly to the President.

Now, to more readily understand this combination plan of cost determination and cost reduction, and just how these cost reduction engineers function and attack their problem, it is necessary that you have an understanding of our cost make-up and cost controls. The system I am going to outline is the one now in operation in both our Minneapolis and Hopkins plants, where the prin-

cipal products of manufacture are tractors, threshers, combines, and industrial engines.

The bases of our costs under our standard cost plan, or better costs standards plan, are specification sheets or Bills of Material. These Bills of Material are furnished us by the Engineering Department who also keep them up to date as to changes, with advice as to the machine serial number on which a change is to take place. Bills of material show in detail kind and quantity of parts going into machines. These bills are costed by our Cost Department who obtain the cost of material, labor and overhead for each part and for the machine as a whole. The detailed cost information shown on the Bill of Material is supported by individual cost cards for each part to facilitate recording of cost changes. The cost of machines is obtained daily by adding to or deducting from previous day's cost, the changes up or down.

I have prepared a representative cost make-up from a set of Bill of Material sheets which is designated Exhibit "A".

The first item of cost on this exhibit is material. You will observe that this cost which is the total Standard Material cost going into the product, is broken down into the various classes, or types, of material. The second item of cost appearing on this exhibit is the Standard Labor cost of the tractor. This is segregated as to the various shops or production centers. Following that is the standard Overhead Cost applying to the standard labor which likewise is broken down as to the various shops or production centers because of the different rates of overhead involved. The next figure is the total standard cost of the tractor. If it were possible for any plant to operate with 100% efficiency, and if our factory was such a plant, the standard cost would also represent actual cost. But because it doesn't, and because there are variations up and down from standard, it is necessary that we add to our standard cost the variations in order to arrive at actual cost. These variations, because they are due to labor efficiency, are applied to each machine on the basis of productive labor in that machine.

Exhibit "B" is what we term a cost progress report. On it are reported all of the changes in the actual cost standards and actual costs that take place from day to day and from time to time. This

is a monthly report which shows accomplishments for the month and for the period.

We break down these accomplishments into the following groups:

1. Foundry Cost. Under X Tractor you will observe that there was a reduction in cost of 24¢ per machine, due to Foundry Operations.

2. Purchased Material. For X Tractor there was a saving of 5¢ per machine, due to the Purchasing Department having been able to obtain a better price for some material.

3. Labor and Overhead. This also represents cost reductions resulting from shop operations due to improvement in shop methods or elimination of certain labor operations.

4. Engineering Changes. On X Tractor these changes resulted in a lower cost by 16¢. On Y Tractor however, there was an increase in cost of $1.45, due to such changes. The Engineering Department is either charged or credited with cost increases, a cost savings due to changes in design, adding of additional equipment or other improvements.

5. Manufacturing Variations. Any changes in the amount of variations per tractor is recorded here and this, too, represents a charge or credit to shop manufacturing department. You will notice, for instance, that the variation costs per machine are $2.04 less in the current year than in the previous year.

Then at the right of the monthly figures you will find the same information for the period. The report shows that the total cost reductions in the standard cost for the 8 months to Aug. 31st were $29.67 on the X Tractor and $18.69 on the Y Tractor, which were broken down in the same way as the monthly savings. Adding to these savings the $2.04 and $2.63 cost reduction in variations of both tractors we arrive at a net reduction of $31.71 and $21.32 in the cost of the X and Y Tractor respectively.

Thus, we not only know how much our reduction in costs has been but we know which departments or in what operations these reductions have occurred.

Under the cumulative variations, Exhibit "B", are shown the amount of material, labor and overhead scrapped during operations, and the labor and overhead variations in excess of those

costs allowed by our standards because of actually paying more than the piece rates set. Thus, we have a cumulative value of these variables by machine which we apply to machines costs on the basis of the percentage that these variables are to productive labor going into the machines. In the report shown, variations happen to amount to $10.59 to every $100.00 of productive labor. It has been our experience, however, that these variables average less than 2% of total machine costs.

And now that you are familiar with the reasons for, and purposes of, these two reports we are ready to go into the matter of our controls and how this information is obtained.

We have one record of stores. That record is kept in the shop under the storekeeper's jurisdiction. It is a record of units only. Very rigid rules govern the handling of this stock—it must be as nearly accurate as it is humanly possible to make it, and certainly it is as nearly accurate in the physical handling as the usual book control accounts are in the financial handling. We prefer a rigid physical control to a doubtful and usually inaccurate book control.

Material for use in our production shops is furnished by the Stores Department without writing of requisitions. For instance we have production shops for tractors. When a lot of 500 tractors has been authorized, the storekeeper furnishes that shop with the necessary material to manufacture these tractors. He does that by reference to the Bill of Material which, as you will remember, shows all the material used in that type of machine. When this system was first put into use, in addition to supplying the material to manufacture, one lot, say 500 tractors, the storekeeper furnished an excess of say 5% to 10%, depending on the nature of the material. This excess or surplus remains fairly constant as spoilage must be accounted for through scrap reports. In other words, the storekeeper furnishes no more material for the manufacture of a lot except upon receipt of a scrap report. It is therefore compulsory for the shop to report all parts scrapped. This procedure keeps the surplus intact because as scrap reports are turned in, material to offset that scrapped is issued. For each successive lot therefore, the shop needs only the material as shown on the Bill of Material without provision for spoilage. The storekeeper in this way is able to control the material going into production by re-

fusal to issue any material other than required by the authorization, except upon receipt of proper scrap reports. Thus, he eliminates the use of material requisitions except for expense material and other material than production material.

In addition to this physical control by which material excesses are reported on variation reports, we also have a material cost control, the results of which are recorded on Exhibit "B" under purchased material. Our inventory is taken as of Oct. 31st of each year and, following our regular basis of pricing material, it is priced at cost or market, whichever is lower. Immediately after the inventory is taken and priced, the bills of material are repriced on the basis of inventory values. After being priced, no change is made on the prices on the bills until the following inventory date, when the new or changed prices are again made effective on the bills of material. However, every purchase order issued by the Purchasing Department is compared with the pricing of the bills of material, which are the same as the inventory. We list every purchase made between inventory dates where there is a variation in price up or down, but we make this list, not when the material is received, but when it is ordered; that is, when we are committed for it. We know at all times, therefore, the exact effect of the purchases on our costs. As most of our material is ordered some six weeks to two months in advance of actual delivery, we not only know the absolute effect on current daily cost but we can anticipate accurately the cost for about two months in advance. The application of the material cost to current cost is made as the material is actually used in the shop. The material is ordered for use at a certain point in the schedule of manufacturing and at that point the material value changes are added or deducted from the material value of the previous inventory. Thus, we get the exact value of the material just as it begins to be used. The importance and value of our material cost control cannot be overestimated. We require no other control of the Purchasing Department. By a very simple process, knitted into our standard cost plan, we get control. Let me repeat that first we have the material value set by the Purchasing Department on the inventory. Bills of material are priced in accordance with this inventory. Orders replaced subsequent to this

are checked against the bills and only the ups and down in costs are listed and recorded on the monthly cost progress report.

The labor going into machines is practically 100% on a piece rate basis. The Timekeeping Department keeps a tracing record upon which all pieces paid for are posted. This information is obtained from the time cards of the men. Any report of pieces in excess of the quantity in the present authorization therefore would immediately be investigated. As spoilage occurs it also is entered on the tracing records so that the following operations are paid for only on the basis of goods parts actually put through. By this method only pieces actually worked on are paid for.

Timekeepers check up the labor cost of the parts manufactured against the piece work rates and segregate therefrom all over these rates. The overs become variations of labor costs and are listed in detail, describing the parts, showing the cause and department, and, of course, the amount. They also list all scrapped material, showing thereon the labor cost involved as well as the description of the part, amount, and so forth.

The other item of cost is overhead, the control of which is obtained through our statement of overhead of which Exhibit "C" is a representative report. A monthly report as well as the cumulative report is made up for each plant each month.

The first column shows the amount of productive labor segregated as to the different shops. The second column, "Variable Shop Expense", shows the amount of shop expense directly controllable by the foreman of each shop department against which it is charged. The bulk of this expense, of course, consists of supplies and expense labor.

The third column, "Share of Direct Shop Expense", shows those items of expense which are of fixed nature like taxes and insurance, and which do not vary with production, even though they are direct overhead expenses of the shop department.

The fourth column, "Share of Indirect Shop Expense", lists the expenses of the various shop service departments such as Stores Department, Inter-Shop Transfer, Shop Administration, etc., chargeable to each productive shop. These expenses are controlled by the various department heads reporting to the Shop Management.

Column five shows the total of all expenses chargeable to each productive shop.

The sixth column shows the percentage of shop expense to productive labor.

The shop superintendent, by watching these percentages, is able to give his attention to those departments whose percentages vary upward.

The percentage of the total expense to productive labor should be lowered with every increase of productive labor as the amount of shop administrative and general expense would total about the same each month, regardless of shop production or the amount of productive labor. Hence, the greater the amount of labor, the lower the ratio of total expense to productive labor, or vice versa. An increase in the rate would signify that more work was necessary for the shop. These percentages represent the actual rates of overhead necessary to distribute completely the overhead for that month, or, on the cumulative plan, for the period covered. Opposite these rates, in the seventh column, are set the actual overhead rates used.

At the bottom of Exhibit "C" is shown the over or under distribution of overhead. A loss here would indicate more work was necessary for the shop.

And so we come to the uses made of all this information obtained by our cost department.

The methods used by our Cost Reduction Engineers (I like the words Cost Reduction Engineers—they mean so much more than merely "Cost Engineers") are simple and direct.

They receive a list of variations every two weeks from the Timekeeping and Cost Departments, showing number of pieces spoiled in that period, listed by part numbers, the dollar value of material, labor and overhead, and extra labor performed, and the departments in which the spoilage took place. As you will remember from Exhibit "B", our variations are made up of:

1. Scrap, consisting of material, labor, and overhead; and
2. Additional labor above standard, consisting of labor and overhead, but not including scrap loss.

The cost engineer then re-groups these items from the Cost Department's report by foremen, and sends the report in duplicate

to the shop superintendent, who discusses it with his foremen and gives each foreman a copy. A summary of these reports is also given to the superintendent and foreman every 3 months. The foremen are thus accurately and promptly informed of losses in their departments and are able to take steps to correct them at once.

In addition to his work with the shop organization in running down, analyzing, and reducing variations, our cost engineers are constantly at work reducing standard costs. This involves study of design and function of parts and materials going into the product, simplification of design, combination and elimination of parts, use of cheaper materials and elimination of operations. They prepare a careful estimate of the cost saving to be expected from each proposed change, and other effects of the change are studied by all departments affected before the change is adopted.

The cost engineers receive copies of the cost progress reports together with the detailed information making up the cost changes during the month, such as the old part number eliminated and the new one used, substitution of some new equipment instead of that previously used, etc. Thus, they are able to keep themselves well informed on actual money saved, and whether or not the contemplated savings actually materialize.

Another phase of our cost reduction work is the making of surveys of our production equipment, and, in conjunction with the shop management and other departments, work out a profitable replacement and modernization program, aiming to replace first machines showing highest production and maintenance costs. The cost engineers are supplied monthly with tabulated lists of maintenance costs on each machine, obtained by tabulating labor and other expense costs by machine numbers.

Still another problem that is common to many manufacturers, and not always solved, is the "thawing out" of depreciation reserves. It is a common mistake to reinvest that portion of cash returns from sales, which should go into replacements of equipment, in material, labor or plant extensions. The result is, that, although the balance sheet usually shows "ample reserves" for depreciation, there is actually little or no cash available for replacements. With our equipment engineer and the shop management continually studying our production equipment and its performance,

and working up their findings into a definite program, we are now working toward an itemized yearly budget of replacements, the total cost of which is approximately equal to our annual depreciation allowance. Frozen depreciation reserves are thus "thawed out", thereby keeping operating equipment in balance with other operations of the business.

Other fields into which cost reduction work has been extended are the study and reduction of gratis service in fields, parts and labor, obsolete parts, engineering expense items, and depreciation of designs and special equipment. Each of these items requires different follow-ups but their cost has been reduced by systematic investigations and follow-up.

Incidental manufacturing costs, comprising general expense items including the hundreds of items of plant supplies and tools, has also come within the scope of this department. Our cost reduction men study the analysis of manufacturing supplies and tools by getting a breakdown of the kind and quantity of tools and indirect materials used on various jobs.

And finally, what have been the results of this dual cost plan, a plan of cost finding coupled with a follow up? Have the expectations of such a plan been fully realized? Is the Cost Reduction Department earning its pay? We'll let the figures speak for themselves.

The largest reduction in cost on any one machine since the plan has been in operation, which is about five years, was $247.00; or, if we apply this reduction to the cost of the machine at the time this system was installed, equal to about 31%. Another machine in production for the last two and a half years has been reduced $86.00 or 13%. And so on down the list. I could enumerate many illustrations. Suffice it to say, however, that the actual results of our cost reduction work thus far have exceeded our most optimistic expectations. It was predicted at the outset that doubtless some substantial savings would be effected at first, but when the high spots of cost had been reduced, further cost reduction would be slow and insignificant. That prediction has not been borne out by the facts. These men are still finding ways to make very substantial savings, and that is to be expected, for better designs and methods are continually being devised.

Now a word of caution is necessary regarding the working out of a plan of standard costs from which you expect to get real results in cost reduction similar to ours, that is, the working out of a standard cost plan coupled up with a follow-up by a Cost Reduction Department. The very basis and life of this plan or combination plan is co-operation. I should say of co-operation and co-ordination. There is what might be a very serious phase of this which you should keep your eyes open for. Down to the last man, our departments and men have co-operated in making the plan effective. Many suggestions came, and continue to come, from the men on the machine work, from foremen and others. Some were good, some were doubtful, some were of no value because of other complications. Extreme care has always been taken to show a spirit of appreciation for suggestions, and these have always been welcomed. But it is very important that while you are making your cost reductions, you do not do this at the sacrifice of your workers. If you do you will find there will come a time when you will be up against a more aggravating problem and it will be serious. For every dollar of cost reduction you make, be sure to offset it with a dollar of sales increase in business. This is where your Sales Department enters into the plan and why co-operation and co-ordination are the very foundation of the plan. It is foolish to expect co-operation when a man can visualize that as a result he is possibly, some day, going to lose his job. He sees others lose theirs—he decides he isn't going to lose his, at least not for the same cause. And it is foolish for us to expect his co-operation.

In my opening remarks I made the statement that accounting records and cost data were valuable, and justified their existence and expense, only in so far as they served as tools of management to maintain and increase profits. I want to emphasize that statement again. Why keep records, make reports, compile cost data. Why spend money and time doing all this if no one is going to make use of such data and information? In the last analysis, whether or not they are used is our responsibility. It is up to us as accountants to see that our records and reports are used and used effectively; it is up to us to sell this idea to our management, and to remove from the accounting department of an organization the stigma of "a necessary evil." Accounting records and cost data

can be used effectively if promptly and properly presented to those who know their purpose and how to use them.

Our experiences in cost reduction have demonstrated to us that for an industry in a competitive field there is no activity on which the management can so profitably concentrate its energies as on cost reduction and control. Consistent and effective use of cost data and control, with its resulting cost reductions, is the best possible safeguard and guarantee of the present and future success of the business.

EXHIBIT "A"

COST ANALYSIS
X Tractor
As of December 31, 1929

Standard Material Costs:		
Grey Iron Castings	$136.19	
Drop Forged Steel	69.16	
Cold Rolled Steel	9.24	
Mild Steel	48.12	
Sheets	8.00	
Finished Purchased Parts	114.27	
Total Standard Material		$384.98
Standard Labor Costs:		
Machine Shop	$ 48.41	
Heat Treat	4.43	
Plate	17.11	
Assembly	19.16	
Total Standard Labor		$ 89.11
Standard Overhead:		
Machine Shop	$ 68.62	
Heat Treat	9.97	
Plate	16.40	
Assembly	24.16	
Total Standard Overhead		$119.15
Total Standard Cost		$593.24
Manufacturing Variations:		
$12.30 per $100.00 of Standard Labor		10.96
Total Factory Cost		$604.20

EXHIBIT "B"

MANUFACTURING COSTS
PROGRESS REPORT
Month of August, 1930

Decrease in Standard Costs	*X Tractor* Month	*X Tractor* Year	*Y Tractor* Month	*Y Tractor* Year
Foundry	$0.24	$ 4.11	$ 0.07	$ 7.44
Purchased Material	0.05	10.22	0.05	12.51
Labor and Overhead	0.11	9.51	0.19	5.99
Engineering Changes	0.16	5.83	1.45*	7.25*
	$0.56	$29.67	$ 1.14	$18.69
Manufacturing Variations				
August	$ 7.09		$12.32	
July	8.84		15.31	
Decrease	$ 1.75		$ 2.99	
Average for 1930	$ 8.92		$15.51	
Average for 1929	10.96		18.14	
Decrease	$ 2.04		$ 2.63	

MANUFACTURING VARIATIONS
Cumulative for 1930

Standard Labor		$322,364.70
Materials scrapped during operations		8,152.66
X	$5,111.38	
Y	3,041.28	
Labor and overhead on material scrapped		3,260.35
X	$2,168.76	
Y	1,091.59	
Labor and overhead variations		22,715.84
X	$9,346.37	
Y	13,369.47	
Total Variations		$ 34,128.85
Per $100.00 of Standard Labor:		
Material scrapped		$ 2.53
Labor and overhead on material scrapped		1.01
Labor and overhead variations		7.05
Total		$10.59

* Figures in red.

EXHIBIT "C"

DISTRIBUTION OF OVERHEAD TO PRODUCTIVE DEPARTMENTS
CUMULATIVE TO AUGUST 31, 1930

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Structural Shops	*Productive Labor*	*Variable Shop Expense*	*Share of Direct Shop Expense*	*Share of Indirect Shop Expense*	*Total Shop Expense*	*% of Shop Expense to Prod. Labor*	*Arbitrary Rates Used*
Structural	$125,000.52	$ 65,298.96	$16,403.76	$ 32,994.36	$114,697.08	91.76	95
Blacksmith	21,263.16	11,455.32	1,600.20	9,662.64	22,718.16	106.84	110
Template	13,093.20	4,704.56	1,020.96	3,604.96	9,330.48	71.26	75
Total Structural Shops	$159,356.88	$ 81,458.84	$19,024.92	$ 46,261.96	$146,745.72	92.09	
Structural Drafting	36,665.76	18,399.12	788.16	1,500.60	20,687.88	56.42	60
Total Structural	$196,022.64	$ 99,857.96	$19,813.08	$ 47,762.56	$167,433.60	85.42	
Mechanical Shops							
Machine and Erection Shop "A"	$141,119.80	$ 71,961.36	$25,440.60	$ 86,718.04	$184,120.00	130.47	100-150
Machine Shop "T"	47,609.80	26,369.40	7,094.84	33,648.60	67,112.84	140.96	100-150
Machine Shop "F"		630.60	361.12		991.72		
Erection Test and Paint Shop	44,910.24	11,991.28	7,980.60	42,799.80	62,771.68	139.77	100-150
Sheet Metal Shop	17,646.48	4,984.80	1,701.00	7,889.28	14,575.08	82.59	80
Heat Treat	4,892.56	3,011.12	714.72	7,161.72	10,887.56	222.53	225
Pattern Shop	15,441.80	6,041.88	1,042.32	4,888.20	11,972.40	77.53	75
Locomotive Round House		61.16	212.08		273.24		
Total Mechanical Shops	$271,620.68	$125,051.60	$44,547.28	$183,105.64	$352,704.52	129.85	

Mechanical Engineering	19,002.64	29,088.72	2,266.56	1,864.32	33,219.60	174.82	175
General Shop Engineering	3,076.60	1,519.56	108.12	750.24	2,377.92	77.29	75
Total Engineering	$ 22,079.24	$ 30,608.28	$ 2,374.68	$ 2,614.56	$ 35,597.52	161.23	
Total Mechanical	$293,699.92	$155,659.88	$46,921.96	$185,720.20	$388.302.04	132.21	
Foundry	69,347.76	80,798.32	10,451.44	37,997.92	129.247.68	186.38	190
Total all Divisions	$559,070.32	$336,316.16	$77,186.48	$271,480.68	$684,983.32	122.52	

EXPENSE NOT CHARGEABLE TO OVERHEAD

Casualty	$ 8,234.16
Garage	3,139.80
	$11,373.96

SUMMARY

	Overhead Distributed	*Actual Overhead*	*Gain*
Structural	$172,937.32	$167,433.60	$ 5,503.72
Mechanical	401,251.24	388,302.04	12,949.20
Foundry	133,703.48	129,247.68	4,455.80
Total all Divisions	$707,892.04	$684,983.32	$22,908.72

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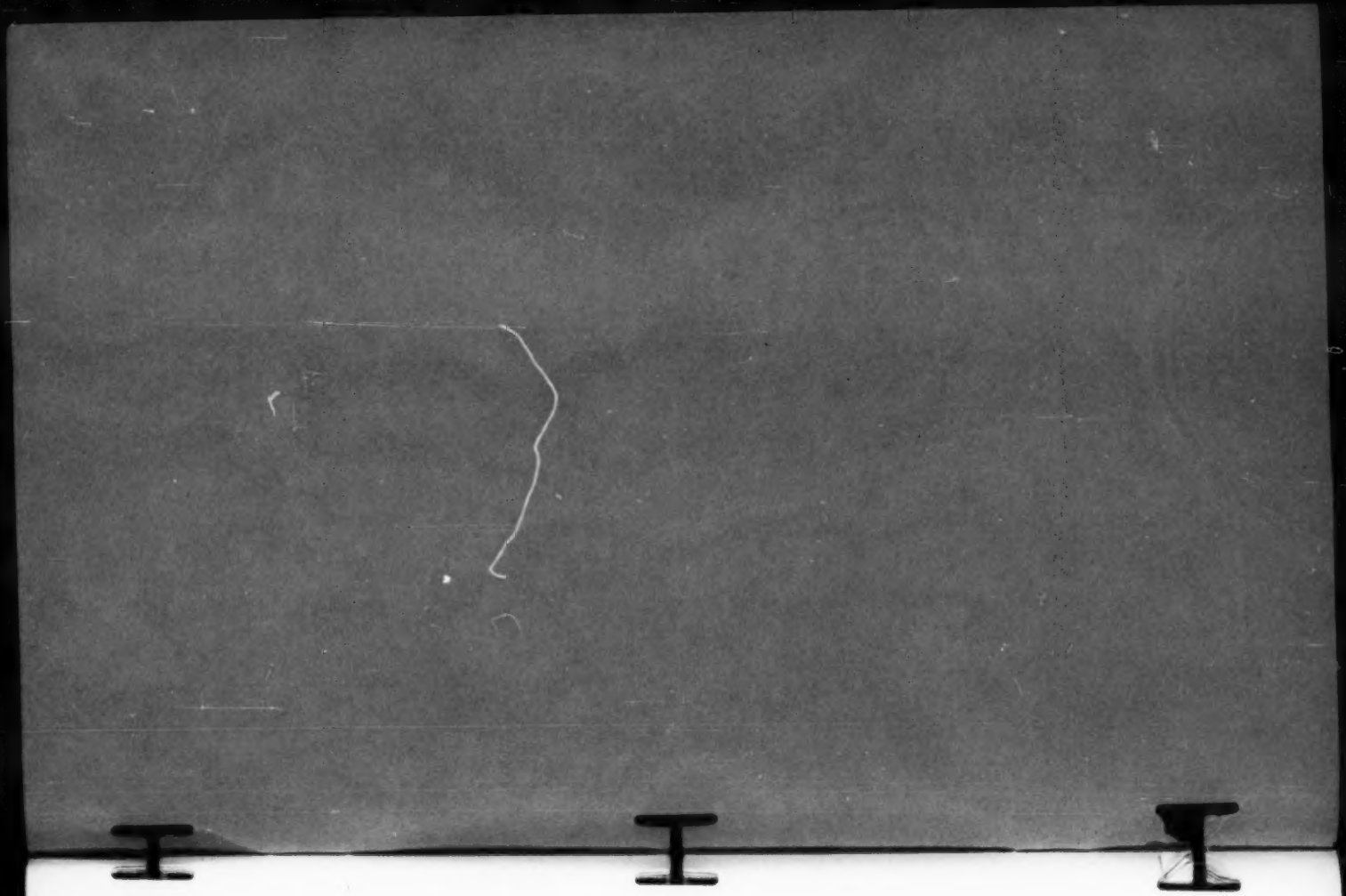

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